PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Satoru OHTA

Docket No: Q81224

Appln. No.: 10/829,179

Group Art Unit: 2818

Confirmation No.: 5944

Examiner: David Vu

Filed: April 22, 2004

For: PROCESS FOR THE PRODUCTION OF ORGANIC TRANSISTOR AND ORGANIC TRANSISTOR

DECLARATION UNDER 37 C.F.R. § 1.132

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

I, Satoru Ohta, hereby declare and state:

THAT I am a citizen of Japan;

THAT I have received the degree of Master of Engineering (degree) in 1997 (year) from Graduate School of Engineering Sciences Kyusyu University (institution);

THAT I have been employed by Pioneer Corporation (employer) since 2002 (date), where I hold a position as assistant manager (job title), with responsibility for fourth group of display device division research (responsibilities);

I am the inventor of the invention described and claimed in the above-identified application.

I am familiar with the Office Action dated August 11, 2006. In regard to the rejection of present claims 6-9 and 11, the following experiments were carried out, either by me or under

my direct supervision to show that the present invention provides unexpectedly superior effects over the closest prior art example.

Inventive Example

In Example 2 of the specification, referring to Figure 2A, a silicon wafer substrate 11 which had a gate electrode formed thereon by a known method was subjected to thermal oxidation to form a gate insulating layer 13 thereon to a thickness of 1,100 angstrom.

At the step shown in Figure 2B, the aforementioned substrate was irradiated with ultraviolet rays for 20 minutes in an ozone atmosphere.

Thereafter, the substrate was allowed to stand dipped in a stock solution of hexamethyldisilazalane (HMDS), dipped in toluene under the application of ultrasonic wave for 10 minutes so that unreacted HMDS was removed, and then dried (HMDS treatment).

Subsequently, at the step shown in Figure 2C, the substrate thus dried was vacuum-coated with pentacene at a pressure of 2×10^{-6} torr and a deposition rate of from 0.4 to 0.6 angstrom/s to a thickness of 500 angstrom to form an organic semiconductor layer 14 thereon.

The substrate temperature was 40°C.

Subsequently, at the step shown in Figure 2D, the substrate was vacuum-coated with gold at a pressure of 2×10^{-6} torr and a deposition rate of from 1.0 to 1.5 angstrom/s to a thickness of 1,000 angstrom to form a source electrode and a drain electrode 15. Thus, a top contact type organic transistor 100 having a channel length of 100 μm and a channel width of 5.0 mm was completed.

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Comparative Example

The comparative example was produced using the same procedures as for Example 2, except that no UV irradiation step was conducted at the step shown in Figure 2B.

The substrate temperature at the step shown in Fig. 2C was 40°C.

Mobility of the organic semiconductor layers produced in Example 2 and the Comparative Example were measured. The measurements are set forth in Table 1 below.

Table 1

Example No.	Substrate temperature	Mobility	UV irradiation conducted ?	HMDS treatment conducted ?
Example 2	40°C	0.52 cm^2/Vs	Yes	Yes
Comparative Example	40°C	0.21 cm^2/Vs	No	Yes

For determination of the mobility of the organic semiconductor layer, drain current was measured at a gate voltage of 30 V. The mobility of the organic semiconductor layer was then calculated in the drain current saturation range using the following equation:

$$Id = (\mu CW / 2L) \times (Vg - Vth)^2$$

where Id is the drain current, μ is the hole mobility, C is the capacitance of the insulating layer, L is the channel length, Vg is the gate voltage, and Vth is the threshold voltage.

As can be seen by the comparison of Example 2 of the invention with the Comparative Example in the specification, wherein the organic transistor was produced in the same manner as that of Example 2 (i.e., same substrate temperature of 40°C in forming the organic semiconductor layer), except that no UV radiation step was performed, the mobility of the organic transistor produced in accordance with the present invention was more than twice as high when the UV irradiation process was performed. Thus, the present invention not only provides unexpectedly superior results over the prior art, but demonstrates that the UV

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irradiation step provides a materially different device than the prior art device (no UV irradiation of the gate insulating layer prior to forming the surface-treated layer).

I declare further that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Date: November 9, 2006

Satoru Ohta

Satoru Ohta